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THE BOTANICAL GAZETTE

EDITORS:

JOHN M. COULTER, University of Indiana, Bloomington, Ind.
CHARLES R. BARNES, University of Wisconsin, Madison, Wis.
J. C. ARTHUR, Purdue University, Lafayette, Ind.

CONTENTS:

The sling-fruit of Cryptotænia Canadensis.—*E. J. Hill* 299
Bacteria of the Melons.—*Byron D. Halsted* 303
Interesting anatomical and physiological researches 305
BRIEFER ARTICLES 311
Pentstemon Hayden, n. sp.: *Sereno Watson*.—A remarkable orange tree: *W. Whitman Bailey*.—Helianthus mollis: *Thomas Meehan*.—Further notes on the mutilation of flowers by insects: *Jacob Schneck*.—A new Ravenelia from Alabama: *Geo. F. Atkinson*.—Cleistogamy in Polygonum acre: *T. H. Kearney, Jr.*—Mutilation of the flower of Tecoma radicans: *Jacob Schneck*.
EDITORIAL 315
The division of the section of biology of the A. A. A. S.
CURRENT LITERATURE 316
Saccardo's Sylloge Fungorum.—A book for children.—A collector's guide.
OPEN LETTERS 318
Nomenclature from the practical standpoint.
NOTES AND NEWS 319
Nicotine in tobacco.—Foreign botanic gardens.—Diseases and enemies of sugar cane.—Mexican ferns.—Test for acid excreted by bacteria.—Journal of Mycology.—Diastase in leaves.—The flora of Baja California.—Rust of pinks.—Underwood's library.—Herbarium of cultivated plants.—Prizes.—Spot disease of tobacco.—Peach yellows.—Greene on nomenclature.

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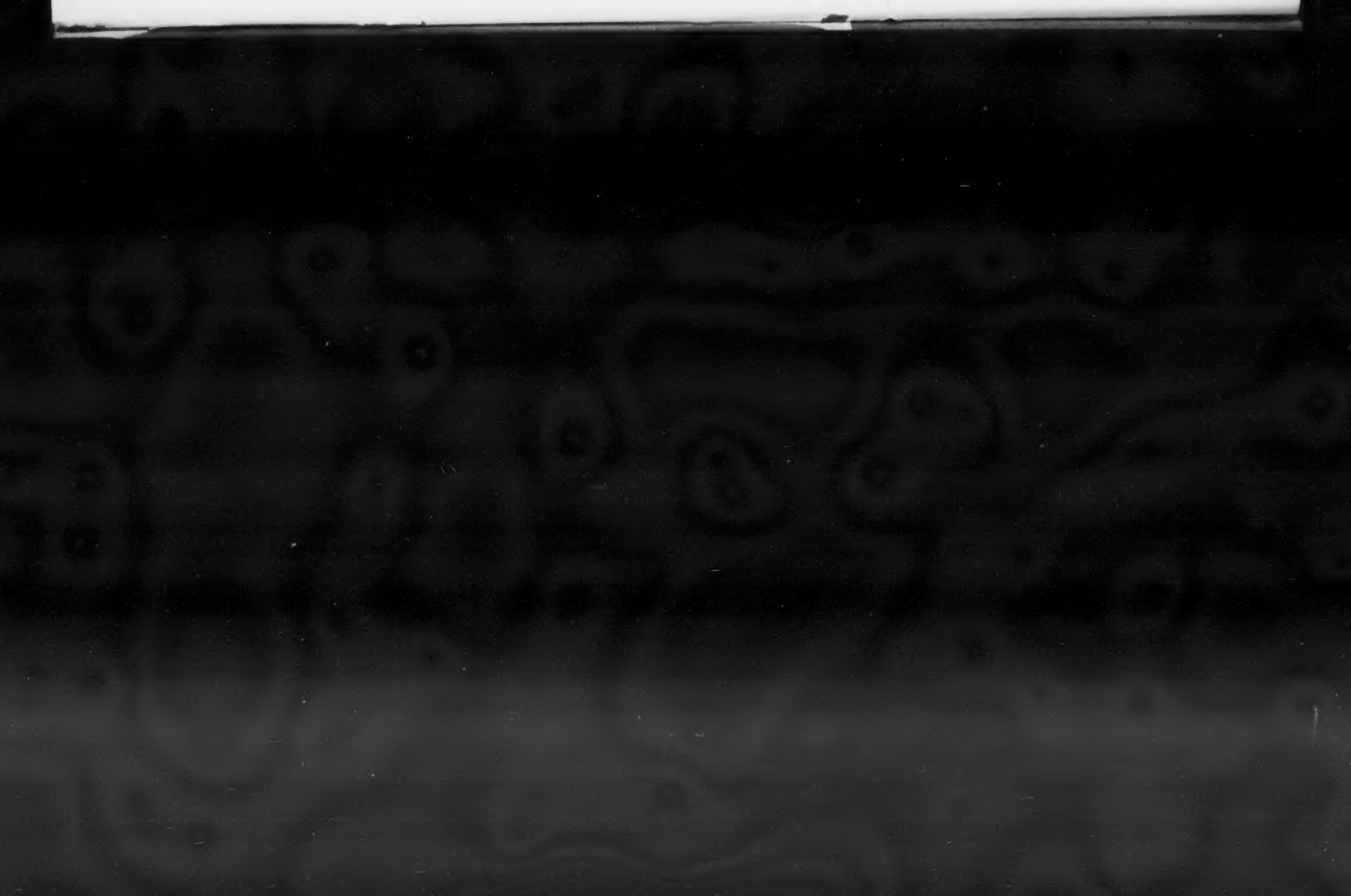


VOL. XVI. NO. 11.—BOTANICAL GAZETTE.—NOV., 1891.

The sling-fruit of Cryptotænia Canadensis.

E. J. HILL.

While passing through the woods in the autumn of 1890 my attention was called to the rattling of seeds falling on the dry leaves which thickly covered the ground. Stopping to see from what plant they came it was found to be Cryptotænia Canadensis. Not knowing that there was anything peculiar in its structure, trials were made of several plants to learn by what contrivance a single one could throw its fruit all around it under the influence of a blow. By striking the stems near the base the fruit was scattered in all directions, some being thrown to a distance of five or six feet. The space on which it fell was somewhat elliptical in shape, the longer diameter being in the line of direction of the blow. It seemed a little paradoxical that a body, unless rebounding from a surface against which it had been thrown, should traverse the path over which the impulse came, but the fact that it did was not to be denied after repeated trials had shown it. Here was a phenomenon to be studied and an explanation found. It was evident that the behavior of the fruit was in some way connected with the elasticity of the stem and branches and its mode of attachment to them. This was about all that was determined on the spot, for the fruit broke away from its support so suddenly that the eye could not readily follow the motion. Almost simultaneous with the blow the sound of impact on the dry leaves was heard. Some plants were carefully gathered and placed in a vasculum to be taken home for study. The experiments then tried have been repeated the present season, and the conclusions reached at the time confirmed by numerous trials. The mechanism and operations by which the fruit is scattered are about as follows.

The mericarps of Cryptotænia when fully ripe split away from each other and hang from the two parts of the carpophore, which are separated above, like a versatile anther on its filament. The branches of the carpophore are flat and very slender. They curve over and are often bent a little

downward at the end by the weight of the carpels, which hang opposite to each other when in their normal position. At this stage in the process of ripening, the carpels have been detached from the carpophore for the greater part of their length, only a small part of it adhering at the extremity. To be completely detached it needs to be stripped up, for the loosening of the carpel takes place from below upward. But the adhesion at the top may be strong enough to turn the fruit over while released under the force of a sudden blow. So it will be slung from its support and propelled the lower end foremost. This end, being less tapering and rather heavier, will facilitate the process.

To illustrate my meaning by a pair of carpels, we will consider the blows as coming from the right hand. By the displacement of the stem to the left under this impulse, and its sudden stoppage when the limit of motion is reached, the energy imparted to the right hand carpel will cause it to turn over in order more easily to tear itself away and it will be thrown to the left of the plant. In some cases it may be jerked from its support and thrown somewhat to one side, being diverted from the line of direction of the blow by stronger adhesion to the carpophore and propelled with a diminished intensity. The left hand carpel may also be detached, particularly if the blow be violent, and thrown forward with the right, since more fruit is sent towards the point to which a blow tends than in the opposite direction. But it often remains attached, the arched and slender carpophore seeming to act like a spring to weaken the shock it would have received, and the carpel is carried forward with the stem on which it is supported, to return with it to the position of rest, or beyond, should the reaction be sufficient. The sudden stopping of the stem when the limit of motion is reached on the return will have an effect on the carpel like that in the former case, but in the opposite way, sending it to the right, or towards the point from which the blow tends.

The clue to this explanation was obtained by experimenting with plants held in one hand and snapping the branches bearing the umbels with the fingers of the other. While working in this way, one of the carpels flew from the stem held in front and a little to one side, and shooting by fell on a table back of my chair. It was heard to fall on some paper lying on the table, and was readily found. The distance from

where it was held to where it lay was nearly five feet, and, being quite close to the nearer edge of the table, it must have remained about where it dropped. The line of direction taken varied but slightly from that along which the blow was delivered. By spreading papers on the floor and experimenting when standing I have found the carpels lying eight feet back of the vertical in which the stem was held. This is a longer distance than would ordinarily be reached by fruit thrown from a plant at its common height.

The scattering of the fruit along the shorter radii of the elliptical area may be explained by the form of branching and inflorescence of the plant. There are several branches terminating in compound umbels, and the ultimate divisions of the stem in the rays of the umbellets are sufficiently numerous to point in all directions. By the principle of physics known as the composition and resolution of forces, resultants will be obtained from the application of a single force and the position of the carpels and their adhesion to the carpophore to coincide with numerous radii. But the distance to which a carpel may be thrown along these lines will necessarily be less than that coinciding with the longer diameter, for the length of a resultant is less than the sum of its components when forces act at an angle with each other, and their intensity is diminished. This, in connection with features previously announced, accounts for the shape of the area covered by the fruit.

Longitudinal sections of the branches of Cryptotænia show that it is well supplied with dotted and spiral ducts, the spiral being abundant. They are very long and numerous near the pith, and will contribute to the elasticity of the stem.

The only other way of accounting for the behavior of this plant in scattering its fruit appears to be that it acts like a bat and ball, the rays of the umbellets striking the carpels and knocking them off, either by their forward movement or on their return. But they seem too slender to have this effect on the relatively heavy fruit, the missile being considerably larger than the body striking it, and suspended in such a way as to receive the blow at the lower end alone. Still this may enter into the process and help in some cases. The mechanism of a missile attached to the end of a spring, or even rigid body, in such a manner as to be easily thrown off by its motion explains the action much more effectually. Here the

individual parts may be slender though the projectile is heavy, since the strain exerted by the force is distributed through a greater length, and is not so violent at a particular point. But the strain is very great when a ball is struck by the end of a bat, as would be the case with the rays of the umbellets, for the center of percussion, where a blow is most effective and where the strain is least, is considerably below the end of a body of nearly uniform thickness. But observation shows that the ends of the rays are not broken in the disengagement of the fruit.

Whether this mode of disseminating fruit is common among the Umbelliferæ is doubtful, because, if frequent, it probably would have been observed in other cases. However, more extensive observations on this point are needed before expressing a decided opinion. But as yet I have seen none that acts in the same manner. But the way in which the carpels split off from the carpophore and are suspended from it must in general facilitate the dispersion of the fruit of Umbelliferæ by shocks received from passing animals, and doubtless from gusts of wind, though not acting like a sling as in Cryptotænia. In an article by Hildebrand on this subject, mention is made of a single genus of Umbelliferæ, *Scandix*, in which the fruit is thrown from its support. But this is due to the tension to which the dry fruit is subjected when adhering to the carpophore, which causes it to be thrown to the right and left through its elasticity when released from stress, and is compared to that which occurs in *Erodium*.[1] This is the only case among the Umbelliferæ of fruits flying off by means of their elasticity cited in his more general treatise, "Die Verbreitungsmittel der Pflanzen," though several other modes of dispersion, with examples in illustration, are given for this family.[2]

Englewood, Chicago.

[1] Die Schleuderfrüchte und ihr im anatomischen Bau begründeter Mechanismus. (Jahrb. für wiss. Botanik, IX. 270.)

[2] l. c. p. 140.

Bacteria of the Melons.[1]

BYRON D. HALSTED.

Early in July there were many complaints throughout the country that the melon, squash and cucumber vines were either not doing well or dying from some unknown cause. The first specimens to arrive were from Bangor, Me., followed by others from the central part of New Jersey, a locality famous for its production of cucurbitaceous fruits.

The attacked vines vary somewhat in their appearance, but generally there is a decay of the stem in proximity to the root, and then the whole plant wilts and fails to grow. Sometimes one or more leaves will fall to the ground and rot away before the balance of the plant is seemingly affected. This is particularly true of the cantaloups, while in the case of cucumbers the fruit may be the first to show the trouble. Here the half grown cucumbers exhibit from one to a dozen or more specks looking like "water cores," which increase in size, until the whole of the fruit becomes a rotten mass, the firm skin still holding the watery interior in shape.

A microscopic examination of the decaying stems, leaves and fruit showed that the decomposing tissues were teeming with bacteria. This was to be expected, but it remained to prove that these germs could be the primary agent in the decay. Inoculations of healthy fruits were made in the usual way by means of sterilized platinum wire, taking the germs from the centre of freshly decaying cucumbers. It was found that with no other fungus present these germs were abundantly able to introduce a rapid decay into cucumbers, melons and squashes. Cucumbers seem to be the favorite, and in them the decay is the most rapid. It will run from one end to the other through the succulent centre of a four inch fruit in a single day. From the placentae the rot spreads towards the surface until all is a noisome pulp inclosed by the skin which may remain unbroken if the inoculation has been made at the stem end.

The next step in the study was the application of these germs to healthy plants in the field. This was done by means of a flamed glass tube one end of which had been drawn out into a long point. By means of this, the germs in liquid,

[1] Read before Section F, A. A. A. S., Washington meeting, August, 1891.

after being drawn into the tube, could be introduced into any part of the plant, even into the woody base of squash vines. When the inoculation was made near the end of a vine, the latter rotted away in from three to four days, and when nearer the base a longer time was required, but in all cases an ulcer was formed which spread more or less rapidly depending upon the tissue infected. In old stems the decay was almost entirely internal, and did not show much until the disease had spread through the pith to some distant soft parts. A medicine dropper was employed to place a charge in the middle of several petioles of large squash leaves. Upon the next visit, twenty-four hours after, all such leaves had fallen to the ground, and the portion of the petioles below the point of inoculation, six or more inches in some cases, were thoroughly decayed. In short, the bacterial disease first found in the cucumber and afterwards propagated from fruit to fruit in the laboratory, as also upon cut stems and petioles, is readily transmitted to vigorous living vines of the cucumber and squash in the field.

Sixteen seeds of summer crooked squash were divided into two equal lots, and each set of eight planted in a flower pot under a bell jar and in every way treated alike, except that the soil of one pot was watered at the beginning of the experiment with the juice of a cucumber which had decayed with bacteria. The eight seeds not receiving the bacterial liquid germinated quickly producing large, deep green plants, while in the other pot only two plants appeared above ground, and they were of a dwarfed, sickly, yellow color, and did not continue to grow. These two plants were quite close to the side of the pot and did not receive a full wetting by the bacterial water. The remaining six seeds when removed from the soil were decayed and noisome.

Eight seeds were next placed upon blotting paper, moistened with distilled water, and kept covered in a small artist's saucer, while a duplicate set were similarly placed, but wet with a solution containing bacteria from a decaying cucumber. Here again the untreated seeds all grew with usual vigor, while those in contact with the bacterial germs failed to germinate and soon decayed.

The pure virus was next introduced into the growing stems and green fruits of the tomato, and in both cases quickly produced a decay that caused the stems to fall and the fruit to

become a watery mass inclosed by the skin, similar to the cucumber from which the bacteria were taken for inoculation. At the time of the experiments some boxes of young tomato plants were close at hand, and into the centre of one of these a decaying cucumber was placed. In six hours some of the stems of the tomato plants six inches in height had rotted off close to the ground, where the liquid from the decaying fruit had come in contact with the young plants. In ten hours all the plants in the vicinity of the decaying cucumber were destroyed. Drops of the virus placed in the leaf axil of other plants quickly induced decay and death of the parts.

The virus from a cucumber was also used upon potato vines in the same manner as upon the squashes, but both the extreme age of the plants and the dry weather may have been unfavorable, as the decay was slow and comparatively harmless. Healthy tubers, however, when inoculated with the cucumber bacteria rotted with that rapidity characteristic of the bacterial decay of the potato. In all cases the tuber became of a pasty softness, and gave off a most unpleasant odor. This decaying substance when taken back to fresh fruit of the cucumbers continued to produce rapid decay.

Rutgers College, New Brunswick, N. J.

Interesting anatomical and physiological researches.

The leaves of aquatic monocotyledons.

M. Camille Sauvageau has just brought to a conclusion his noteworthy memoir[1] on the leaves of some aquatic monocotyledons. To the physiologist this contribution to a little known department of botanical science is no less interesting than to the morphologist. The studies of the author have been principally upon the *Potamogetonaceæ* (see Ascherson's monograph in Engler and Prantl: *Die natürlichen Pflanzenfamilien*), and for the forty-eight species examined he announces that the histological characters of the leaf alone will be sufficient for identification. He finds, moreover, in *Zoste-*

[1] Ann. Sci. Nat., Botanique, 7. 13, pp. 102–296; *Sur les feuilles de quelques monocotyledones aquatiques.*

ra, *Phyllospadix*, *Halodula* and *Potamogeton* that there is a remarkable water-pore at the apex of the leaf, formed by the disintegration of certain epidermal cells. This pore is in communication with the vascular system of the leaf and together with the ordinary stomata on the under surface facilitates the passage of a current of water through the whole organ. By means of immersing cut-off shoots of *Potamogeton*, etc., imbedded in the ends of bent thistle-tubes containing water and attached to a mercury pressure-guage, in jars of water, Sauvageau demonstrates experimentally the absorption of water by the leaves. He concludes that there are currents of water, comparable to the water-current of transpiration in land-plants, in the leaves of the *Potamogetonaceæ*, and that, when deprived of their roots, these plants may continue to live and prosper by absorbing water and salt-solutions through their leaves. Plasmolytic phenomena noted indicate that in these plants the absorption of water may take place over the whole surface of the leaf.

In general it may be said that these extremely able and careful investigations of Sauvageau go far to show that absorption of water is, in some cases, an "important normal function" of leaves. This has not yet been entirely clear, notwithstanding the well-known experiments of Mayer and Boussingault. —CONWAY MACMILLAN.

Structure of living protoplasm.

Probably the recent article by M. Fayod[1] upon this subject is as startling and difficult to reconcile with preconceived and accepted notions, as any physiological memoir that has appeared since the early days of karyokinesis literature. M. Fayod announces that protoplasm is not an emulsion, as it has lately been characterized by Bütschli and Quinke, nor is it a zoögloea-like by-product enclosing bacterioid *zell-granula*, as the Hartigs have indicated, nor a "complicated mixture" as Berthold somewhat indefinitely calls it. It is, on the contrary, a highly intricate network of spirally twisted, corkscrew-like, hollow fibrillæ, each possessing a hyaline wall negative to all staining reagents and capable of great dilation by the liquids or emulsions within. The nucleus is a peculiar knot of *spirofibrillæ*. The cell-wall possesses exactly the

[1] Rev. générale de Botan., May, 1891; *Structure du protoplasma vivant*

same organization as the protoplasm. It is protoplasmic fibrillæ impregnated with cellulose. Certain obscure physiological problems are luminously explained under this view, viz., cell-growth, geotropism, ascension of sap, irritability in general, heliotropism, budding, and movements, such as those of amœbæ, plasmodia, bacteria and the diatoms. The method of M. Fayod—leaving aside the detail—is to inject bits of tissue with indigo, very finely powdered and in suspension. The preparation is dehydrated with alcohol after the usual method, and is examined in clove-oil. In this way it is possible to inject the spirally-twisted protoplasmic fibrillæ and thus expose them for examination and study. In seed-coat cells of *Cuphea* for example, the spirofibrillæ are found to have exactly the structure of a capillitium-fiber from certain *Trichias*—a genus of *Mycetozoa*.

This distinctly original view of protoplasmic constitution will, of course, need verification. It seems certain that peculiar spirally-twisted elements may be demonstrated in protoplasm by any one who follows Fayod's method, which is not a tedious one. The writer obtained results with epidermal cells from young *Pelargonium* leaves.

With the space at command, it is not possible to discuss fully the ingenious explanations which, under his conception of protoplasm, M. Fayod offers for the various physiological phenomena which present themselves to his notice. To most readers of his paper, however, it is certain that no page will be more interesting than the one on geotropism. Very simple, physical and mechanical laws suffice for the explanation of this *crux* of plant-physiologists. By the weight of liquids in the spirofibrillæ, under the action of gravity, longitudinal tension, in the cell-lining, is decreased and cell-formation takes place more readily along the line perpendicular to the surface of the earth. And the more gross materials will collect in the lower portions of fibrillæ and in the lower fibrillæ, leaving the finer, ethereal, easily dialysable substances uppermost, thus tending to inflate upper parts of fibrillæ and upper fibrillæ. Under such conditions of the mechanism, together with the variation of environment, nutritive rhythm, and changes periodic and constant in metabolic processes and products, Fayod finds little difficulty in explaining very clearly both geotropism and negative geotropism (*zenotropism*, turning toward the zenith). He quotes effectively the ex-

periments in aggregation of Drosera-protoplasm which have become classic, and notes the more recent results of Elfving and Wortmann who find that the protoplasmic layer is thicker on the *under* side of cells in a negatively geotropic (zenotropic) organ.

It is impossible to dismiss so carefully prepared and important a paper as this of Fayod with a shrug of the shoulders, as has been done, the author observes, with his earlier notes on the matter. Especially in view of the recent advances in karyokinesis study, as indicated in the researches of Watase, Guignard, Carnoy, Zacharias, Pfitzer, Strasburger and others, it is evident the older emulsion-theory of protoplasm is beset with grave difficulties. It is probable that even so admirable a work as Berthold's *Studien über Protoplasmamechanik* does not say the last word upon its subject-matter. Fayod's paper is an original and valuable contribution to the most fundamental question of both plant and animal physiology.—CONWAY MACMILLAN.

The relations of the phloem.

Within a few years our knowledge of the phloem region of the fibro-vascular bundles has been greatly extended. Not to go so far back as 1885, in which year appeared Hérail's Étude de la tige des Dicotylédons[1] in which the phloem received extensive consideration, we have last year Lamounette's extensive researches into the origin of the internal liber of the so-called "bicollateral" bundles.[2] Lamounette rejects the term "bicollateral" as did Herail, who considered it applicable only to the Cucurbitaceæ. In this terminology the internal phloem was looked upon as coordinate with the external phloem; whereas according to Lamounette (whose researches agree generally with those of Hérail where they touch common ground) the internal phloem is not developed from the procambium which produces the bundle, but arises from the pith parenchyma. It is not always easy to distinguish these two tissues, though in most cases this is easy because the internal phloem arises later than the xylem, so that the first formed spiral and annular vessels come to indicate the internal limits of the procambium before the internal phloem

[1] Annales d. Sci. Nat. Bot. VII. ii. 267.

[2] Annales d. Sci. Nat. Bot. VII. xi. p. 193–278.

begins to develop. In the Cucurbitaceæ, however, the differentiation takes place at the same time, but even in this case Lamounette will not allow the applicability of the term "bicollateral." Every gradation in time of appearance is found between the Cucurbitaceæ and the Basellaceæ in which the appearance of the internal phloem is very late.

Lamounette investigated the hypocotyl, stem and cotyledons of a large number of plants by the aid of serial sections cut by the collodion method.

At the beginning of this year Leonhard published his researches into the anatomy of the Apocynaceæ[1] which show that the internal phloem occurs throughout this order, with possibly one exception.

In the August number of the Annals of Botany Scott and Brebner have an extended account of their studies as to the relation between the stem and root-structure in plants with bicollateral bundles and the special modifications of the stem-structure in plants which belong to this category. They adhere to the term bicollateral as a matter of convenience without expressing any opinion as to the order of development, and cite the term "vascular bundle," as a convenient expression not now generally representing a well-defined unit, but applied to vascular tissues even when the limits of the individual bundles cannot be traced. "So long as an internal phloem strand has the same longitudinal course as the neighboring bundles of the leaf-trace there is no serious objection to regarding them as parts of the same formation."

"Bicollaterality is a character widely prevalent among the most highly organized dicotyledonous families [18 are known] and of great systematic value. It may fairly be maintained that these orders represent in certain directions the most advanced types of dicotyledonous structure.

"The physiological importance of bicollaterality cannot be fully estimated until the general question of the functions of the phloem has been finally determined, but it is undoubtedly great. The sheltering of a portion, often the larger portion, of the delicate phloem within the woody cylinder is an obvious advantage, as is also the fuller utilization of the pith-area and the consequent concentration of the tissues generally. It is probable also that the pith-cells themselves may be able to discharge both storing and conducting functions more effi-

[1] Botanisches Centralblatt, xlv. p. 1.

ciently when brought into direct relation with the phloem and its proteid contents.

"In concluding we wish to point out the bearing of our subject on a theory which has recently been put forward as to the function of the phloem in general. In opposition to the prevailing view that the phloem is primarily a conducting tissue for the nitrogenous and especially for the proteid food-substances of the plant, Prof. Frank and Dr. Blass maintain that the phloem is essentially a store tissue for the benefit of the wood. (See this journal xv. 346.)

"We purposely avoid criticising Dr. Blass' arguments. . . . We willingly admit that in all plants with cambial growth, the supply of food materials for such growth must be an important function of the phloem. . . . But we wish to point out that the anatomical relations of the phloem are often quite inconsistent with the supposition that its principal or exclusive function is connected with the formation of wood.

"In all the numerous plants which have bicollateral bundles or an analogous arrangement of tissues, a great part of the phloem, often the greater part, and sometimes nearly the whole, is placed in that region of the stem where no formation of wood is going on, in a position as remote as possible from the wood-producing cambium, for the rare exceptions in which internal wood is formed may here be left out of consideration. Yet this internal phloem is absolutely typical in structure and contents. . . .

"So too with the phloem islands. In plants like Strychnos, these are no sooner formed than they become imbedded in dense wood, and are cut off from all direct communication with the cambium. It would be easy to cite other examples, as the stems of the Chenopodiaceæ and many other allied orders, in which almost all of the phloem is deeply imbedded in the fully-formed wood, or the monocotyledons generally, where the closed bundles retain a typical and active phloem for months and years after all formation of wood has been completed.

"In the light of facts such as these, we cannot but think that the view of Prof. Frank and Dr. Blass depends on too one-sided a consideration of typical dicotyledonous anatomy. . . . Our results as to the continuity of the various phloem-systems in root and stem tend to give further anatomical support to the theory of the conducting functions of

this tissue, a theory which, we need hardly point out, is fully consistent with the view of Prof. Sachs, that the phloem may also be the seat of proteid-formation."—R.

BRIEFER ARTICLES.

Pentstemon Haydeni. n. sp.—Of the *Genuini* group: a foot or two high, glabrous, the stems decumbent, simple or branching, very leafy: cauline leaves, linear-lanceolate to linear, entire, 3 to 5 inches long by 1 to 3 lines broad, sessile and clasping: inflorescence a compactly crowded thyrse, the floral bracts from ovate-lanceolate and long-acuminate to ovate and acute, nearly equaling or the lower much exceeding the flowers; peduncles none or short: calyx-lobes acuminate, 3 to 5 lines long: corolla an inch long or more, the throat broadly dilated and the limb nearly equally lobed: sterile filament, bearded near the summit: capsule equaling the calyx.

This plant was first collected by Dr. F. V. Hayden, in the Laramie mountains of Wyoming, during some one of his early surveys, without flowers or fruit, and was referred by Dr. Gray to *P. acuminatus* as a form with linear cauline leaves. It was rediscovered during the past season, in flower and fruit, by Mr. H. L. Webber, of the Shaw School of Botany, on the Dismal River in Thomas county, Nebraska, about a hundred miles west of the 100th meridian. It has nearly the habit of the more conspicuously cordate-bracted forms of *P. acuminatus*, but with an extreme of discrepancy between the cauline leaves and floral bracts. The flowers are much larger and the throat of the corolla more dilated.—Sereno Watson, *Cambridge, Mass.*

A remarkable orange tree.—There is in the herbarium of Brown University a specimen which is something of a curiosity. It was sent us last spring by Mr. Rowland Hazard, one of our trustees, from Santa Barbara, Cal. I quote from his letter of transmission.

"It is an orange tree which for years has lived and borne fruit without bark for a space of over seven inches entirely round the tree. I first saw this tree in February, 1885. It had been injured by a fire about three years before. When I saw it first it had a number of ripe oranges on it and in March it bloomed and bore fruit in the fall. The trunk was in substantially the same condition as you now see it. There was a space just above the ground where there was no bark and the sap-wood had rotted away, leaving only the heart-wood as the

connection with the root. I bought the place on which the tree was, in 1885. The tree has borne and ripened oranges every year till 1890. In 1889 a sprout came up from the root. This proved to be a Chinese lemon on which the orange had been grafted. I was not here in 1889. When I arrived in the fall of 1890 I saw that shoots from the orange had been sent out the preceding spring but they had withered and died. The Chinese lemon was very thrifty and full of fruit. It evidently had taken the sap. The struggle was over and the orange was dead. I send you the whole of it with a part of the Chinese lemon shoot. I think it should be preserved, as it is proof positive of the circulation of sap through the heart-wood. It lived, blossomed and bore fruit every year for at least seven years, when there was no connection between the tree and the root, except the heart-wood."—W. WHITMAN BAILEY, *Brown University*.

Helianthus mollis.—Plants which I collected near Odin, Illinois, years ago, and plants from Tennesseee, sent by my friend, Dr. Gattinger, were blooming in my garden the past year. The Tennessee plants flower two weeks before the others, have involucral bracts double the length, and the leaves one-fourth broader, though no longer. The leaves of the Illinois plants are so thick that the nerves can scarcely be seen; the nerves of the other are strongly visible, and there are some other differences.

In these days variations of this character are scarcely worth special note. We find similar variations with any plant in areas of but a few acres in extent if carefully looked for.

In the Illinois plants I have noted that all the first flowers faced the southeast, the first day of opening. This season they all faced the northwest. I might settle the whole story by merely saying, "something in the environment must have influenced all these variations;" but to my mind the term "environment," so frequently used in connection with similar phenomena, is utterly meaningless. It is, however, clear that there are often separate lines of variation in widely separated localities. Sometimes I think we might solve the problem sooner if we were not so easily satisfied with the word "environment." THOMAS MEEHAN, *Germantown, Philadelphia*.

Further notes on the mutilation of flowers by insects.—In the GAZETTE for 1888, p. 39, I state that *Bombus pennsylvanicus* slits the corolla tube to obtain the nectar from *Physostegia Virginiana* and *Mertensia Virginica*. There was a mistake made in copying the name of the insect from the original notes; it should read *Xylocopa virginica*, the Virginia carpenter bee. Since the above mentioned note was pub-

lished I have repeatedly seen this bee visit these two species of plants, and in addition, the following: *Pentstemon pubescens*, *P. laevigatus*, *Pontederia cordata*, *Astragalus Canadensis*, and *Trifolium pratense*. It invariably, so far as my observation goes, slits the lower end of the corolla tube in order to reach the nectary. It is said to be the largest and most bulky of all known bees, the mouth parts being very highly organized. It appears to disdain to take its food in the usual slow fashion of other insects, but goes directly through the tissues to the nectary.

I have repeatedly observed the honey bee (*Apis mellifica* L.) visit all these plants, and it apparently prefers to take the nectar through the slits that have been made by the carpenter bee; but when it does not find a slit already made, it then goes to the mouth of the tube and visits the flower in the usual way, by entering at the mouth of the tube.

The common humble-bees are frequent visitors to all these, and many other flowers, but I have never seen them take the nectar in any other way than by the mouth of the corolla. *Bombus pennsylvanicus*, *B. americanorum* and *Apathus elatus* (the latter now thought to be the male of *B. americanorum*) are the only species which I have taken from flowers, and that have been certainly determined; but it is reasonable to conclude, from the structure of their mouth-parts, that all the members of this genus take nectar in the same way.—Jacob Schneck, *Mt. Carmel, Ill.*

A new Ravenelia from Alabama.—In September, 1890, and during the autumn of 1891, the writer has collected at Auburn what proved to be an undescribed species of Ravenelia on *Cassia nictitans*. The species is remarkable for its great abundance on the stems and for the very long, fulvous pedicels of the teleutospores. It is characterized as follows:

Ravenelia Cassiæcola Atkinson, n. sp.—Caulicolous or hypophyllous. Sori on leaves one mm. or less, rotund or oblong; on stems oblong, irregular, confluent, sometimes covering space 1—10 cm. or more in length, frequently ambient, rupturing irregularly or longitudinally. Pseudo-peridium composed of closely cohering, irregularly angular, small cells, yellowish brown. Uredospores in mass appearing dirty yellowish white; singly, hyaline or dull yellow to fulvous, oval or rotund, minutely asperulate, 9–13×12–16 μ. Teleutospores in mass appearing black; singly, fulvous to dark brown; 30–100 μ, convex at free end, depressed where joined to pedicel, small ones rotund, composed of from 5–30 cuneate cells, their free ends frequently bearing a single hyaline, short spine; cells 18–23×20–30 μ; cystoid cells 5–15, rotund, hyaline or colored, rigid, 14–18 μ; pedicel fulvous, stout,

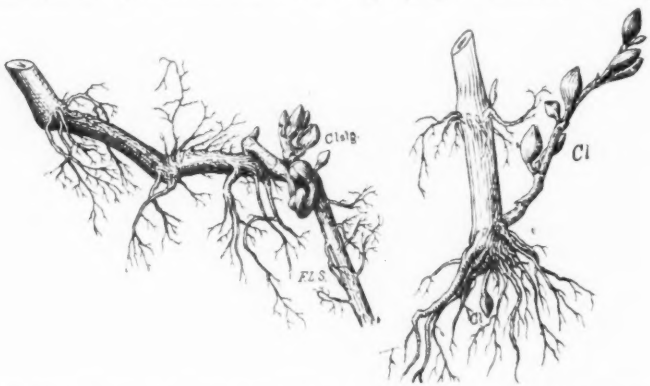
50 - 80 μ long.— On stems, leaves and pods of Cassia nictitans, Auburn, Ala., *Geo. F. Atkinson;* Starkville, Miss., *S. M. Tracy.*

Frequently there is very little of the fungus on the leaves, it being chiefly caulicolous. Occasionally it is abundant also on the leaves, but the sori are comparatively small. Sometimes all the sori on the leaves contain only uredospores, but again teleutospores as well.

I have had an opportunity of comparing this species with *R. stictica*, Berk. & Br., n. 554 Myc. Univ., *R. glandulæformis* Berk. & Cur., n. 1251 Myc. Univ., and *R. Texanus* Ell. & Galloway.

I have also collected at Auburn, during the month of September, 1891, *R. glandulæformis* B. & C. on *Tephrosia hispidula* and *Virginiana*, and my assistant, Mr. B. M. Duggar, has collected it on *Tephrosia spicata.* The specimens on Tephrosia Virginiana are of interest from the fact that the fungus is very abundant on the stems, the sori being longer and often confluent, presenting much the same appearance to the unaided eye as Ravenelia Cassiæcola on Cassia nictitans.— Geo. F. Atkinson, *Department of Biology, Ala. Polyt. Inst., Auburn.*

Cleistogamy in Polygonum acre.—Apropos of Mr. Meehan's discovery of cleistogamy in Polygonum, I would record the observation of cleistogamous flowers on the same species, P. acre, at Knoxville, Tenn., on the 24th of September. For the accompanying illustrations, showing



the appearance of plants in question, I am indebted to Prof. Scribner. I have searched for cleistogamic flowers on other species of Polygonum, but without success.— T. H. Kearney, Jr., *University of Tennessee.*

Mutilation of the flower of Tecoma radicans.— During the past twenty years I have frequently found flowers of our common Trumpet

Vine split at the lower portion of the tube; the slit usually extending through the upper two-thirds of the calyx, the lower portion of the corolla-tube and down to the nectary. All this time I have been on the lookout for the author of these depredations, and only during the past month have I been successful in detecting him at his work.

For several years my suspicion has been resting on *Icterus baltimore*, for I have on a number of occasions seen him fly from a clump of these flowers in such a manner as to make me believe he had been at work on them; but I did not wish to whisper such a report about a bird of such an unusual beauty, unless I knew it to be true. But several weeks since, while sitting concealed by a window, which is within a few feet of a thrifty Trumpet Vine, then in full bloom, I detected a pair of Baltimore Orioles in the act of slitting the flowers as above described and taking the nectar; since then this observation has been repeated several times.— JACOB SCHNECK, *Mt. Carmel, Ill.*

EDITORIAL.

AT THE Washington meeting of the American Association notice was given of an amendment to divide the Section of Biology. Of course this means to separate the zoologists and botanists; and as the matter will be up for discussion and decision at the next meeting, it is just as well for botanists to begin considering its advisability. The notice of amendment was prompted by two considerations: (1) The extremely crowded program, which compelled the cutting down and mutilation of some of the most important zoological and botanical papers, and also entirely prevented in many cases the presentation of papers by some of our most distinguished biologists. (2) The numerous technical papers in each biological division which were unintelligible to the other. The first consideration may possibly be weakened by the fact that there was, at Washington, a conjunction of an unusually large attendance of biologists and an unusually short allowance of time for reading papers. But three days were allowed, four being the usual number. However, the attendance will be more likely to increase than to diminish, and the working days of the association will probably remain those of the Washington meeting. The second consideration is also an important one, for with the reading of every paper it becomes very apparent that "one-half the world doesn't care how the other half lives." Upon the whole, the GAZETTE is now inclined to favor the amendment, providing such a division will not diminish the in-

terest of the Botanical Club, an exceedingly valuable organization, and one whose informal meetings cannot be duplicated by a Botanical Section of the Association. Even if the division into botanical and zoological sections be made, it will always be desirable to have certain papers of general biological interest read in joint session, a thing commonly provided for in other sections.

CURRENT LITERATURE.

Saccardo's Sylloge Fungorum.

The enumeration and description of all known fungi, a work of enormous magnitude, was begun a decade or more ago by Prof. P. A. Saccardo, of Padua, Italy. The first volume appeared in 1882, and the eighth and last of the regular enumeration two years ago. The eight, thick, royal octavo volumes contained the description of 31,927 species.

It was to be expected that some species would be overlooked, and that new ones would be constantly added, so that the work is no sooner finished than it needs a supplement. The first number of such a supplement is already issued, and botanists will feel under a special debt of gratitude to the author for the promptness with which it has been prepared.

The *Supplementum Universale* is to consist of two volumes, the first of which bears date of September, 1891, and the second is promised for 1892. The present volume [1] is as thick as the thickest of those which have preceded, and contains descriptions of 4463 species, distributed among six large groups, as follows: Hymenomyceteæ 1083, Gasteromyceteæ 72, Hypodermeæ (Ustilagineæ and Uredineæ) 249, Phycomyceteæ 139, Pyrenomyceteæ 2903, and Laboulbeniaceæ 17.

The volumes containing the Pyrenomyceteæ were issued in 1882–3, which partly accounts for the great preponderance of species in that group. The Laboulbeniaceæ appeared in the final volume, 1889, with only 15 species, and the 17 additions of the supplement were all derived from the two publications of Dr. Roland Thaxter, and are all American. Thus the largest and earliest published group shows an increase of 47 per cent., and the smallest and latest published group shows an increase of 113 per cent. Even if we take into view the rusts

[1] Saccardo, P. A.—Sylloge fungorum omnium hucusque cognitorum: Vol. IX, Supplementum universale. Pars I. pp. 1141. Roy. 8vo. Padova. 1891.—fr. 57.

and smuts, which are among the best worked of the fungi, and which show 8 per cent. increase since the volume on that group came out three years ago, the rate at which new species are published is almost appalling, and makes a work like the present well-nigh indispensable.

A book for children.

The books which are adapted to stimulate the interest of children in the plant-world are few enough, when all are enumerated, and those that are even tolerable can be counted on the fingers of one hand. It is with much pleasure therefore that we welcome another,[1] for it belongs distinctly to the better class. Mrs. Bergen has very happily named her little book "Glimpses at the Plant World," and they are surely enticing glimpses which ought to engender a desire for fuller knowledge. In thirteen chapters of five or six pages each the author describes engagingly the different types of plants, yeast, moulds, toadstools, lichens, fresh-water and marine algæ, mosses, ferns and flowering plants. The remaining chapters, about as many more, deal with the fertilization of flowers and the methods of seed distribution, topics which are in their nature attractive and are here made so for children.

Mrs. Bergen's style in this book is easy, in places colloquial, and what is of much greater importance the statements which she makes are not only well put but correct. We recall none that is absolutely incorrect andvery few that one would even wish changed on account of possible misconception. The publishers have given the little book a tasteful dress, but some of the illustrations are open to criticism; such as that of diatoms (?) on page 38, which is only a three inch black circle, with a few scratches in it. The text deserves the best and most artistic work.

A collector's guide.

A new guide for collectors of phanerogams appears from the hand of Professor Penhallow.[2] It contains concise directions for the collection and drying and mounting of phanerogams chiefly, though enough reference is made to the mosses to urge objections against the use of half-size sheets for such smaller plants, objections which appear weighty to the author, we venture to say, only because he never tried

[1] BERGEN, FANNIE D.—Glimpses at the plant-world. 16mo. pp. vi. 156. Boston: Lee & Shepard. 1892. [*sic.*]

[2] PENHALLOW, D. P.—The botanical collector's guide: a manual for students and collectors; containing directions for the collection and preservation of plants and the formation of a herbarium. 16mo. pp. 125. figs 8. Montreal: E. M. Renouf. 1891.—75 cents.

the small paper. We note also that standard paper is given as 11×17 inches, which does not quite agree with that most used on this side of the boundary. An appendix shows samples of labels, of mounting and drying paper, genus covers and pockets "for seeds and mosses." (There is a much better form for mosses, by the way.) On the whole the directions are excellent, clear and simple, and in the neat form given them by the publisher, come just at the right time to help along the *renaissance* in collecting to be wrought by the Botanical Club of Canada.

OPEN LETTERS.

Nomenclature from the practical standpoint.

There is one point in this matter of botanical nomenclature on which, with all due respect, very many writers on the subject seem to have gone astray. It has been assumed that there is no reason why botanical nomenclature should not follow the same rules as zoological nomenclature, and hence the priority of names can be as rigidly maintained in the former as in the latter system. This may be very well in theory, but in practice the cases are very different. In zoology generally the scientific names are not in common use outside of scientific circles, while in botany they are. This difference is owing not only to the greater popularity of the latter science, but to the great development of horticulture among the people. In consequence the Latin generic and specific names of plants are used almost as often as some English equivalent, and in many cases to the entire exclusion of so called "common names." This being the case the attempt of certain botanists to change well known names of plants for no other reason save to carry out their own pet theory of nomenclature is almost as hopeless from a practical point of view as an attempt to revise and change the common names of plants in accordance with the individual taste of a certain school of botanists. The nomenclature of a science is not necessarily so much a part of the science that only scientific men can pass on it. Accepted usage has its rights, and generally maintains them whether in accord with theory or not.

A more analogous case, it seems to me, is that of geographical nomenclature. Here also popular usage is a factor, and at once the folly of trying to lay down strict, inviolable rules becomes apparent. Time and time again have the good old historical names been supplanted by names of modern origin, and it would be well nigh useless to make even an attempt to restore them unless the attempt is to be made by authority of the government, not of the individual. Just here appears one of the weakest points of the "strict priority rule" of botanical nomenclature — that it is the creation of the individual, not only unsupported by such governmental botanical authority as we possess, but directly opposed to it in many important particulars. In other words, individual opinion tries to oppose such botanical consensus as we now have in order to carry out its own private theory.

The right of the people to well known botanical names in common use is not likely to obtain much consideration from the herbarium botanist, neither is the application of a statute of limitations to fix definitely the acceptance of such names, yet there is good legal analogy for such a method of treatment, and it would be the business-like and the most familiar way to deal with the subject from a practical standpoint. The advocates of the "strict priority rule" no doubt started with the best intentions and after much careful consideration, but it now seems as if they regarded more the framing and enforcement of an easy rule to follow than a practical rule to secure the most good. Surely their attempts to simplify botanical nomenclature have not given us much relief as yet, and in very many cases show more the ill-directed zeal of the pedant, than the calm, deliberate, common sense judgment of the master. In their attempt to suppress individual dictation in specific cases they claim for themselves the right to dictate the acceptance of a rule that many of us are far from being convinced is the only rule to be followed. We must take the *ipse dixit* dose at the outset instead of later: that is all! Moreover recent events show that this rule, like any rule based on historical facts, does admit of difference of opinion in specific cases, the very evil, I judge, they sought to avoid. Altogether the present condition of botanical nomenclature shows the usual result of allowing theorists to deal with practical matters; for I maintain most stoutly that botanical nomenclature is a living, practical, popular question, and deserves to receive common sense, business-like treatment where there is need of it.

What I have said applies only of course to the so-called "strict priority rule," that extreme, that hard-and-fast rule which enforces priority without exception, reasonable or unreasonable. That priority furnishes a sound foundation for a satisfactory system of nomenclature seems to me beyond dispute, and the work that is being done in many directions is most useful and helpful. When, however, the application of the rule becomes more an object than the avoidance of confusion, when the digging up of long dead, often still-born names becomes of more importance than the retention of names well known and for years accepted by both popular and scientific usage, then many of us feel that temperance is indeed a virtue in questions of botanical nomenclature as well as in other matters of life. Let us at least wait for the action of a Botanical Congress possessing authority, before we accept the tyranny of a rule that knows no exception, listens to no reason, and claims for itself with very little justice, the inviolability of a natural law.— EDWARD L. RAND, *Boston, Mass.*

NOTES AND NEWS.

DR. A. W. SCHIMPER, of Bonn, has declined a call to the University of Marburg on account of his health.

OUR ATTENTION has just been called to a misleading error on page 199 which escaped correction in the proof. In line 16 from the bottom *Pirus* should read Pinus.

MR. FRANCIS DARWIN's address, as President of the Biological Section of the British Association, was upon "Growth-curvatures in plants."

A NEW "Old-man Cactus," from Lower California, is figured and described by C. R. Orcutt in *Garden and Forest* (Sept. 16). It bears the name of Cereus Sargentianus.

IN EXPERIMENTING upon the climatic conditions for the development of nicotine in tobacco plants, Mr. A. Mayer concludes that increase of heat, light and atmospheric moisture all increase the percentage of this alkaloid.

THE *American Journal of Science* has begun an interesting series of papers, by Dr. George L. Goodale, describing the museums and botanical gardens in the equatorial belt and in the South Seas, which the author recently visited.

IN THE FIRST report of the Sugar-cane experiment station in West Java, W. Krüger has a paper on the diseases and enemies of sugar-cane, which would probably be of value to some of our southern stations. It is published by G. Schönfeld, Dresden.

THE FERNS collected during the past three years in Mexico by Mr. Pringle are being enumerated by Mr. George E. Davenport in *Garden and Forest.* The new species described in the first two parts are Asplenium Pringlei (Sept. 23), A. dubiosum and Hemionitis elegans (Oct. 14). The first and last are figured.

BEVERINCK has proposed[1] a neat test for the excretion of acids by bacteria. He adds to the nutrient medium enough finely divided chalk to make it milky white and opaque. On growing acid-forming microbes in such a medium the colonies of these will render the opaque medium transparent in their vicinity, owing to the solution of the carbonate.

THE *Journal of Mycology* is making itself more and more useful to mycologists, both those of the experiment stations and those who can study mycology for its own sake. Vol. VII, no. 1, issued Sept. 10, marks a new epoch, as it becomes with this new volume the organ of a Division of the Department of Agriculture, and not simply of a section of the Botanical Division.

VINES OBJECTS to Wortmann's view (see this journal XV. 346) that green leaves contain no diastase or only such a small quantity that it is insufficient to account for the transformation of the starch they manufacture into sugar. He has re-investigated the subject and his recent experiments point to the same conclusions as the earlier ones of Baranetzky and Brasse, namely, that there is diastase present in green leaves, and that it does convert the starch into a sugar.

MR. T. S. BRANDEGEE has just published a paper on the "Flora of the Cape Region of Baja California." This very interesting region, known until recently only from the Sulphur and Xantus collections, is being thoroughly investigated by Mr. Brandegee, and also by the Bo-

[1] Centralb. f. Bakt. 9. 781.

tanical Division of the Department of Agriculture. The present paper brings the scattered material together, 179 species being enumerated, 29 of which are new.

A RUST of carnation pinks (*Uromyces caryophyllinus* Schroet.) has appeared in several places in Indiana, and threatens to be a serious pest to florists. It was brought to the attention of Dr. J. C. Arthur the middle of last month, and investigations show that it is already well distributed in the state, some large greenhouses not having a plant free from it. It has long been known in Germany and southern Europe, but this is believed to be the first time it has been reported in this country.

PROF. LUCIEN M. UNDERWOOD, of DePauw University, Greencastle, Ind., has decided to devote his time exclusively to botany, and offers his entomological library for sale. It contains sets, mostly complete, of American serial publications, the nine Missouri reports by Riley, bound in 2 vols., with index; Fitch's fourteen reports bound in 3 vols., with MS. index; Löw & Osten Sacken's Diptera complete, and many other rare and valuable works. It also includes the nearly complete literature on N. A. Arachnida.

THE ORCUTT Seed and Plant Co., San Diego, Calif., announce the preparation of herbarium specimens of all cultivated plants, which they intend to test at San Diego. The labels will give botanical and vernacular names, descriptions drawn from the fresh plant, color, historical, economic and cultural notes. It is hoped that botanists and horticulturists will lend assistance to the work, as cultivated plants are generally neglected in herbaria.

THE ROYAL Danish Academy of Sciences at Copenhagen offers two prizes of 400 and 600 kronen, respectively, (a) for investigations on the sorts and proportions of the more important carbohydrates present at different stages of ripeness of the four chief cereals; and (b) for investigations of the Phytoptus galls which are found in Denmark with a monographic treatment of the species of the genus of insects producing them. The latter investigation is desired especially to clear up the question as to whether on the same species of plant a given species of Phytoptus may produce different galls at different stages of its development. The prizes are to be awarded in October, 1893.

SOME RECENT researches by Drs. Frank and Otto, of Berlin, have shown that the green leaves of plants are at evening richer in nitrogen than in the morning, and that the leaves themselves show an accumulation of nitrogen, when they are separated from the plant, placed in water and exposed to the direct sunlight. These investigators deduce from their results some conclusions as to the harvesting of plants for fodder (such as clover) which need testing on a practical scale. They recommend the cutting of clover late in the day, preferably toward sunset of a warm, clear day, in order that the greatest amount of the nitrogenous foods, which have the highest nutritive value, may be secured.

IWANOWSKY AND POLOFZOFF describe in the Mémoirs of the St. Petersburg Academy (VII. xxvii. n. 7) a spot disease of tobacco, caused

by a deficient supply of water, which may be occasioned either by a poor development of the root system owing to a lack of potash in the soil, or to lack of moisture in the soil owing to poor cultivation. The spots appear on the lower leaves first, and spread to the upper. They are of very different form and size, frequently enlarge and fuse, and sometimes the tissue involved breaks away entirely. The whole mischief is often wrought in two or three days. Is not the plant subject to the same trouble in this country? Better tillage, selection of ground, with proper exposure and rotation of crops are advised.

THE STUDY of the peach yellows has been a most discouraging task' but Mr. Erwin F. Smith, who has for several years been at work upon the disease for the Department of Agriculture, has shown great perseverance in its investigation. In an address before the Peninsula Horticultural Society at Easton, Md., he asserts that the disease on that peninsula is increasing, and that he has definitely ascertained by inoculation experiments that the disease is contagious. No preventive measures or treatment have been able to check it in the least. In Michgan, however, the eradication of every diseased tree has practically suppressed the trouble, and this is recommended to the Delaware and Maryland growers. While several organisms have been found associated with the diseased tissues, none has yet been proved to be the cause of the malady.

THE LAST PART of *Pittonia* (Vol. II., part 10), just issued, is an interesting one, as all the parts are. Of course numerous new species are described. Achætogeron is included under Erigeron and its species properly renamed. The most interesting part is always that which deals with ancient names of genera, as one never knows what unheard of name is to be suggested for his old friends. In the present paper 9 genera are thus treated and their 79 species renamed. *Polanisia* is changed to *Jacksonia* Raf., *Wistaria* to *Kraunhia* Raf., *Riddellia to Psilostrophe* DC., *Troximon* to *Agoseris* Raf., *Pyrrhopappus* to *Sitilias* Raf., *Cordylanthus* to *Adenostegia* Benth., *Echinospermum* to *Lappula* Mœnch., *Microstylis* to *Achroanthes* Raf., and *Symplocarpus* to *Spathyema* Raf. A new and promising field of nomenclature is opened up in the case of revertible names. No genus is now to be allowed to bear a revertible name (that is one that appears as the more ancient synonym of any other genus). Accordingly, simply by way of mentioning "but a few out of many changes" which are promised, the author proceeds to coin generic names. *Pickeringia* Nutt. is renamed *Xylothermia; Nuttallia* T. & G. is *Osmaronia; Darlingtonia* Torr. is *Chrysamphora; Crantzia* Nutt. is *Lilæopsis; Rafinesquia* Nutt. is *Nemoseris; Torreya* (used with 5 genera) is *Tumion* (this time of Raf.). In the same part, Professor Greene replies to the criticisms that have been made of his citation of ancient botanical authors, and also inveighs against the Negundo Negundo and Catalpa Catalpa departure in nomenclature.

Published by Theodor Fischer, Cassel, Germany.

Bibliotheca botanica

Edited by

Prof. Dr. Luerssen and Dr. F. H. Haenlein.

Just Issued:

Heft 22. **G. Karsten,** Ueber die Mangrove-Vegetation im Malayischen Archipel Mit 11 Tafeln. M. 24.—

Heft 23. **J. Reinke,** Beitræge zur vergleichenden Anatomie und Morphogie der Sphacelariaceen. Mit 13 Tafeln. M. 24.—.

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